**Problem Solving: Eliminating Possibilities**

**What Is It?**

Eliminating Possibilities is a strategy in which students remove possible answers until the correct answer remains. Here's an example of a problem that can be solved by Eliminating Possibilities:

The product of an unknown number multiplied by four is less than 35. The unknown number is divisible by four. What two numbers could the unknown number be?

The answer can be found by eliminating the numbers that do not meet the rules and choosing the numbers (four and eight) that remain.

**Why Is It Important?**

This is a problem-solving strategy that can be used in basic math problems or to help solve logic problems. Eliminating possibilities helps students organize information and evaluate which pieces of information they will use, eliminating the information that does not fit. It encourages students to consider all options and narrow the possibilities to reasonable choices.

**How Can You Make It Happen?**

Introduce a problem to students that will require them to eliminate possibilities in order to solve the problem. For example:

In the game of football, a team can score either a touchdown for six points or field goal for three points. If a team only scores touchdowns or field goals but does not get any extra points (no points for an extra kick) what scores cannot be achieved if the team scored under 30 points?

1. **Understand the Problem**

Demonstrate that the first step is *understanding* the problem. This involves identifying the key pieces of information needed to find the answer. This may require students to read the problem several times or put the problem into their own words.

In this problem, students understand that there is a finite set of possible answers. Students will have to find all of the possible answers and then narrow down the list according to the criteria in the problem.

The score can be 1 through 29.  
The score must be a multiple of 3 or 6.

1. **Choose a Strategy**

The strategy of eliminating possibilities can be used in situations where there is a set of possible answers and a set of criteria the answer must meet.

1. **Solve the Problem**

First, list the numbers 1 through 29, because the problem states that the score was less than 30.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

Next, eliminate answers that are not possible solutions. Work through each criteria to find the solution.

Any multiple of six would be a possible score of the game. If the team only scored touchdowns, they could score 6, 12, 18, 24 and so on. Therefore, all multiples of six should be eliminated.

1 2 3 4 5 \* 7 8 9 10 11 \* 13 14 15 16 17 \* 19 20 21 22 23 \* 25 26 27 28 29

Any multiple of three would be a possible score of the game. If a team scored only field goals, they could score 3, 6, 9, and so on. Therefore, all multiples of three should be eliminated.

1 2 \* 4 5 \* 7 8 \* 10 11 \* 13 14 \* 16 17 \* 19 20 \* 22 23 \* 25 26 \* 28 29

The answer to the problem is that the following scores could not be the score of the game:

1, 2, 4, 5, 7, 8, 10, 11, 13, 14, 16, 17, 19, 20, 22, 23, 25, 26, 28, 29

1. **Check**

Read the problem again to be sure the question was answered.

The scores that would not be possible in this game are listed.

Check the math to be sure it is correct.

Look through the answers you have eliminated and those that are remaining to make sure you have applied all the criteria in the problem.

Determine if the best strategy was chosen for this problem or if there was another way to solve the problem.

Eliminating possibilities was a good strategy to use for this problem.

1. **Explain**

The last step is explaining how you found the answer. Because this strategy involves logic, it is important for students to talk or write about their thinking. Demonstrate how to write a paragraph describing the steps you took and how you made decisions throughout the process.

First, I listed the possible scores. Then I started to eliminate scores that were not possible. I found the multiples of six and crossed them out. Then I found the multiples of three and crossed them out. I was left with all of the possible scores.

1. **Guided Practice**

Have students try solving the following problem using the strategy of eliminating possibilities.

Find the numbers between 10 and 30 that are divisible by 4.

Have students work in pairs, in groups, or individually to solve this problem. They should be able to tell or write about how they found the answer and justify their reasoning.

**How Can You Stretch Students' Thinking?**

Math problems can be simple, with few criteria needed to solve them, or they can be multidimensional, requiring charts or tables to organize students' thinking and to record possibilities as they are eliminated.

This is an example of a problem that can be solved using logical thinking and eliminating possibilities.

Tom, Tanya, and Josh live on Main Street. Two of them live on the right side of the street. The other one is across the street. One house is painted red, another has a circular driveway, and a third house is made of brick. The brick house is on the left side of the street. Tom has a pickup truck, which is parked in his circlular driveway. Tanya lives across the street from Tom. Which house does Josh live in?

You could [make a chart](http://www.teachervision.fen.com/math/problem-solving/48897.html) like the one below to help organize the eliminated possibilities because the question is multidimensional.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | **Josh** | **Tanya** | **Tom** |
| Painted Red | | | Yes | x | x |
| Circular driveway | | | x | x | Yes |
| Brick House | | | x | Yes | x |
|  |

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